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TITLE OF INVENTION

"Secure Mobile Office Wireless Local-Area Network Application Integration Package
Running from CD-ROM"

BACKGROUND OF THE INVENTION

The Invention is in the field of InterNetworked Computer Systems. It is designed to provide enhanced security in general, and specifically to provide for rapid deployment of Secure Mobile Offices with full InterNet server and laptop-workstation capabilities, operating in and supporting a Secure Wireless Local-Area Network ("LAN") as well as supporting general InterNet operations and Virtual Local-Area Network ("VLAN") operations.

BACKGROUND OF PROBLEM

Security is increasingly a concern on the global InterNet. A wide variety of attacks have been launched against many online sites, including invasions of networked computers which are responsible for monitoring and control of critical economic and physical infrastructure, including computers which control elements of the electrical power distribution system, and computers which control dams. Fears of terrorist exploitation of such weak systems are reasonable fears, and a variety of methods have been proposed to increase the security of these networked machines.

Also, rapid data communications between members of organizations, and between organizations, is increasingly vital, and in no case is it more vital than in a situation of emergency response. These communications must be secure, as a variety of bad outcomes may emerge if communications can be intercepted, with or without modification and retransmission.

Situations will probably occur which will require rapid deployment of non-military response teams to sites of chemical, biological, or radiological attacks, or similarly catastrophic events. Possession of secure data networking technology may be essential to responders to such events. Disruptions in supply lines, procurement systems, or the disruptive nature of emergency situations might make it difficult to get the necessary computing resources into the field, and lack of standardization may further complicate matters, particularly if there are incompatibilities between operating systems. There is a clear need for a standardized Secure Mobile Office Network Application Package. Furthermore, such Secure Mobile Offices must be lightweight, consume little power, be extremely portable at a moment's notice, and should be networked mostly wirelessly as an aid to rapid deployment and ease of relocation and reconfiguration in the field. Further, such Secure Mobile Offices must enable logins to remote computers, in the case where insufficient local capacity exists to perform specific operations better done from the headquarters. Such logins to remote computers must be exceptionally secure so as to not enable attackers to imitate such logins and gain access to the headquarters computer.

Secure Mobile Offices might, if deployed into a precipitated catastrophe such as the recent destruction of the World Trade Center on 2001 September 11, come under direct attack through their networking systems. Thus, their network "hardening" is of high importance. Further, multiple layers of hardening should be applied, so that if any one layer is penetrated another will be encountered.

In networked systems, one of the more feared attacks is one where the attacker penetrates and assumes enough control to alter the contents of non-volatile storage, for example, replacing password files on a harddrive. Such a "root compromise" can turn a computer into the cybernetic equivalent of a ticking time bomb, and in fact the computer may be usurped and turned into a launching point for a variety of attacks against other networked machines. At the very least, all security may be disabled without the knowledge of the legitimate user, turning their machine into an attacker's window into the inner workings of the organization's methods and techniques. Ordinarily networked computers are part of a large and complex system which has a variety of means to trace the source of such attacks, such as "dial-up pen-registers"; however, wireless mobile networks could very easily come under attacks through their wireless connections and should be highly hardened against potential penetration to, and alteration of, their non-volatile storage systems. The present commercially-available wireless encryption systems, which are the first line of defense against such attacks, are known to be very weak and easily compromised.

SUMMARY OF INVENTION

This Invention permits very rapid installation of operating systems onto off-the-shelf hardware. Furthermore, this Invention addresses multiple configuration issues pertaining to the creation of "InterNet Hosts", and thus enables the very rapid installation of operating systems preconfigured to boot into a "ready to internetwork" mode with no subsequent configuration needs. It integrates several different existing security and encryption models which are considered robust. Further, the media on which this Invention will be distributed are read-only, providing further defense against InterNet-based attacks.

DETAILED DESCRIPTION OF THE INVENTION

Our invention is a Secure Mobile Office Applications Integration Package which runs entirely from CD-ROM on computers which do not have the capability to write to the CD-ROM. This package integrates two separate layers of encryption and authentication suitable to both wireless and hard-wired TCP/IP (IPv4 and IPv6) networked data communications. This Package is intended to be used in "ensemble operations" where there are at least two computers running with the Package: one of which serves as a Kerberos authentication server, as well as a firewall and firewall-traversal proxy (SOCKS5) which both permits authorized wireless networked computers to access the global InterNet, and which disallows unauthorized networked computers on either side of it to access the other side of the firewall; and, one or more "client" machines, laptops equipped with wireless communications cards.

We chose the Linux operating system as it is very robust, and used the Slackware version 7 distribution with a version 2.4.17 kernel rebuilt to incorporate the "FreeSWAN" IPSEC IP-security system for authentication and encryption. Alternatives such as the MicroSoft Windows (tm) operating system were rejected as being too expensive and vulnerable to attack. We also rejected approaches using any variant of "SSH" or "OpenSSH" ("secure shell") for our host-to-host remote login application; instead we used the MIT "Kerberos" system for authentication and encryption of remote logins and remote application activation. We used the "PCMCIA-CS" software which enables the Linux kernel to operate PCMCIA ("PC Card") devices, including the popular Hermes "Prism-I" chipset IEEE 802.11b-

standard wireless communication cards. We wrote scripts to allow operation entirely from CD.

OPERATION

When the kernel is booted and starts the "init" process which controls startup and runlevel, it calls several scripts. Our special script:

- initializes portions of random-access internal memory into "ramdisks", and creates filesystems there. These are the only read-write elements of this operating system
- copies, from the CD, into ramdisk, those directories and files from the Linux system which must be read-write for the operating system to function
- creates, in ramdisk, a "swap space", or virtual memory area, to permit operations exceeding the non-reserved random-access memory of the computer
- loads into memory and executes such kernel modules, code libraries or applications as are necessary for standard operation
- initializes and starts the wireless communications card (and if so equipped, an ethernet PCMCIA network interface card)
- establishes wireless communications with its wireless-access point and its SOCKS5 firewall traversing proxy, and negotiates and authenticates to establish IPSEC triple-DES-encrypted TCP/IP data communications (client machines); or, alternatively, establishes IPSEC communications with authorized hosts such as headquarters computers, and starts to proxy between the wireless mobile network and the hardwired global InterNet (firewall mode), and also starts up the Kerberos authentication server.
- establishes virtual private networks between headquarters and the proxy servers, including NFS (UNIX network file-system) mounts of remote mass-storage, between client machines, and any IPSEC-capable computers which must be accessed.
- excludes all TCP/IP communications with devices not specifically authorized to participate in this Secure Mobile Office Wireless Local-Area Network, other than those communications required to carry the virtual-private-network encrypted TCP/IP packets.

DETAILED DESCRIPTION OF THE INVENTION

This system is based on "Slackware Linux 7.1", Linux kernel version 2.4.17, and "FreeS/WAN-1.95", and MIT Kerberos 5-1.2.2., and "PCMCIA-CS-3.1.31". All are freely available from the InterNet. The system also makes use of the SOCKS5 Advanced Programming Interface ("API") specification and a variety of vendors sell products which make use of this API to act as "proxies".

To create the basis of the system, install the full distribution (with the exception of "X-Windows and X-Windows applications) of Slackware Linux 7.1 in the recommended manner on a secondary harddrive on an Intel-x86 platform machine running any recent version of Linux, and boot to the new Linux installation. Unpack the FreeS/WAN package in the recommended manner. Unpack, build, and install MIT Kerberos 5 binaries and libraries in the recommended manner. Install your SOCKS5 proxy in the recommended manner.

Unpack and configure the linux-2.4.17 kernel package. Configure to build for the intended hardware platform, with maximum modularity to assure that a kernel is built which is small enough to be capable of stand-alone boot from a 1.44 megabyte floppy. Configure to build to include all standard networking features such as TCP/IP, and PPP. Configure to support "RAMDISK", with 8 ramdisks of 16384Kbytes in size. Many other kernel configuration options exist but are not generally relevant to this particular Specification. Complete configuration and build and install the kernel and kernel modules. Reboot to the new kernel to test operability. If the kernel works, build and install the FreeS/WAN IPSEC package which will rebuild the kernel and install the rebuilt kernel. Reboot to the new kernel to test the kernel, and make a "boot floppy" from this new IPSEC-capable kernel. Unpack, configure, build and install the "PCMCIA-CS" package in a manner appropriate to the intended destination machine and relevant kernel configuration options.

Shutdown in an orderly fashion and reboot to the primary harddrive. Mount the secondary harddrive to the primary filesystem in some convenient place. For example we will specify the directory `/mnt/proto`.

Modify initialization scripts in the directory `/mnt/proto/etc/rc.d` to conform to those appended in the CDROM labelled "Appendix CDROM-A". These scripts will run at boot time to create filesystems in ramdisk and load those filesystems with the appropriate files as bootstrap progresses. This completes the basic creation and configuration.

At this point, one could create an "ISO-9660 image" and burn it to CDROM, and one could use the "boot floppy" to boot the CDROM in any Intel-x86 platform PC with 128 megabytes of RAM, but multiple copies of such a CDROM would be duplicates of each other and would interfere with each other if operated simultaneously on the same non-world-routable subnets, or on the world-routable InterNet.

In production for clients, we will copy the entire contents of `/mnt/proto` to another directory, for example `/mnt/installer`. A variety of scripts will take care of such tasks as generating a series of IP addresses, hostnames, Kerberos keytabs and configuration files, IPSEC configuration files, SOCKS5 configuration files, etc., as necessary to provide each individual CDROM with a unique network identity, "personalization", and encryption key. As each instance of the package in `/mnt/installer` is provided with a unique identity and encryption keys, it will then be converted to "ISO-9660 image" and burned to CDROM. The final result will be a number of CDROMs, each of which will boot with a unique network address and network identity, and with all other "individualization configuration" issues resolved.

Once a series of these CDROMs has been generated, they can be inserted into any laptops or workstations based on the Intel-ix86 platform which are equipped with 128 megabytes of RAM and a CDROM drive, and IEEE-802.11b Wireless-LAN PCMCIA cards which are supported by the "PCMCIA-CS" software package. When the bootstrap procedure is finished, if an IEEE-802.11b "Wireless Access Point" is available, these laptops will be full-featured "InterNet Hosts" in a network exchanging data with at least one layer of triple-DES encryption at all times, ready for users to log in and begin their work.